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## PRAGMATIC COMPREHENSION IN SCHIZOPHRENIA: A SYSTEMATIC REVIEW AND META-ANALYSIS

**This is the author's manuscript**

*Original Citation:*

*Availability:*

This version is available <http://hdl.handle.net/2318/1777662> since 2021-03-05T11:17:22Z

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# Title: Pragmatic comprehension in schizophrenia: A systematic review and meta-analysis

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## INTRODUCTION

Individuals with schizophrenia (SCZ) frequently show a severe and widespread impairment in the communicative-pragmatic domain. They exhibit difficulties in the comprehension of a wide range of communicative-pragmatic expressions, such as indirect speech acts (ISA), irony, metaphors, proverb and idioms. Communicative disorders play an important role in the social impairment experienced by these patients, and they are frequently associated with functional and social outcome. However, results of previous studies showed large variation across different samples, communicative phenomena and type of pragmatic task investigated. As a result, the state of the evidence for communicative difficulties in SCZ is not completely clear.

We performed a systematic review of previous literature assessing pragmatic comprehension in schizophrenia, and a meta-analysis of the evidence. The aim of the meta-analysis was to: 1) investigate differences in pragmatic comprehension between individuals with SCZ and HC 2) compare differences in pragmatic comprehension across different phenomena, i.e. irony, figurative language (FL, idioms, proverbs and metaphors), and ISA.

## METHODS

We used the "PRISMA Statement" guidelines for transparent reporting of a systematic review, and the study was preregistered on Prospero Register of Systematic Review. We performed a systematic literature search on the following database: PsycInfo, Pubmed and Google Scholar. Selection of the studies was conducted according to the following inclusion criteria: (a) empirical study, (b) quantitative measures of pragmatic comprehension of participants with SCZ, (c) sample including at least two individuals with SCZ (d) inclusion of a comparison group.

Finally, 37 studies were identified as eligible for inclusion, and among these 27 studies provided enough data to be included in the meta-analysis.

We used mixed effects regression models for each relevant pragmatic phenomena, i.e. FL, irony and ISA, to calculate summary effect sizes (Cohen's d).

## RESULTS

The results showed significant meta-analytic effects of schizophrenia in pragmatic comprehension of FL (22 studies,  $d: -1.74$ , 95% CIs:  $-2.49$   $-0.93$ ,  $p < .001$ ), irony (12 studies,  $d: -1.42$ , 95% CIs:  $-2.3$   $-0.5$ ,  $p = .001$ ), and ISA (3 studies,  $d: -1.37$ , 95% CIs:  $-1.9$   $-0.8$ ,  $p < .001$ ). The standardized effect sizes were large, thus indicating that individual with SCZ have serious difficulties in the comprehension of the different communicative expressions compared to healthy individuals.

The heterogeneity between studies was significant (FL:  $Q(32) = 245.1$ ,  $p < .001$ , Irony:  $Q(12) = 134.8$ ,  $p < .0001$ , and ISA:  $Q(3) = 25.2$ ,  $p < .0001$ ). The rank correlation test indicated evidence for publication bias for figurative language (Kendall's tau (K) =  $-0.35$ ,  $p < 0.001$ ), while was not significant for irony and ISA (Irony:  $K = -0.33$ ,  $p = 0.13$ , ISA:  $K = -1.00$ ,  $p = 0.08$ ).

## CONCLUSIONS

Overall, we found that individuals with SCZ showed clear difficulties in the comprehension of different pragmatic expression, i.e. FL, irony and ISA, compared to healthy controls. This result is in line with previous studies indicating pragmatic impairment as a core deficit in schizophrenia.

The effects were large for all the pragmatic phenomena, with figurative expressions showing the largest effect followed by irony and ISA. However, we reported the presence of publication bias for studies investigating figurative language expressions. Heterogeneity between studies was large and significant for all the three phenomena, thus suggesting a large variability across studies in the characteristic of the tasks used to investigate pragmatic ability, and in the characteristics of the experimental samples assessed.